

(12)

(88) Date of publication A3:

(51) Int Cl.:

(43) Date of publication A2:

(21) Application number: **07250479.8**

(22) Date of filing: **06.02.2007**

(84) Designated Contracting States:

AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
SK TR

Designated Extension States:
AL BA HR MK YU

(30) Priority: 13.02.2006 US 352400

(71) Applicants:

- **ASML Netherlands B.V.**
5504 DR Veldhoven (NL)
- **ASML Holding N.V.**
5504 DR Veldhoven (NL)

(72) Inventors:

- **Van Haren, Richard Johannes Franciscus**
5583 XM Waalre (NL)
- **van der Schaar, Maurits**
5658 AK Eindhoven (NL)
- **Vreugdenhil, Ewoud**
5551 XE Valkenswaard (NL)
- **Sewell, Harry**
Ridgefield
CT 06877 (US)

(74) Representative: **Leeming, John Gerard**

J.A. Kemp & Co.
14 South Square
Gray's Inn
London WC1R 5

(54) **Lithographic projection apparatus and device manufacturing method**

(57) A method of forming features, e.g. contact holes, at a higher density than is possible with conventional lithographic techniques involves forming an array of sacrificial positive features, conformally depositing a sacrificial layer so that negative features are formed interleaved with the positive features, directionally etching the sac-

sacrificial layer and removing the sacrificial features. The result is an array of holes at a higher density than the original sacrificial features. These may then be transferred into the underlying substrate using a desired process. Also, the method may be repeated to create arrays at even higher densities.





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 25 0479

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 5 328 810 A (LOWREY TYLER A [US] ET AL) 12 July 1994 (1994-07-12)	1-3,5,6, 11,12, 14,16,17	INV. H01L21/768
A	* column 1, line 18 - column 8, line 52; figures 1-4,7-11,14-23 *	4,7,19, 21	
D,X	J.P.LONG ET AL.: "Edge Defined Lithography for Nano-scale III-N Field Effect Transistors" THE INTERNATIONAL CONFERENCE ON COMPOUND SEMICONDUCTOR MANUFACTURING TECHNOLOGY 2005 ON-LINE DIGEST, no. 14.22, 2005, XP002437708	1-3,5,7, 11,12, 14,16,17	
A	* the whole document *	4,6,21	
D,X	CHOI YANG-KYU ET AL: "A SPACER PATTERNING TECHNOLOGY FOR NANOSCALE CMOS" IEEE TRANSACTIONS ON ELECTRON DEVICES, IEEE SERVICE CENTER, PISACATAWAY, NJ, US, vol. 49, no. 3, March 2002 (2002-03), pages 436-441, XP002437709 ISSN: 0018-9383 * abstract * * page 436 - page 439, paragraph 1; figures 2,3,4f *	1-3,5,7, 11,12, 14,16	TECHNICAL FIELDS SEARCHED (IPC) H01L
D,A	US 2003/203320 A1 (SABNIS RAM W [US] ET AL SABNIS RAM W [US] ET AL) 30 October 2003 (2003-10-30) * page 3, paragraph 33 - paragraph 37; figure 1 *	1-13	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 27 August 2007	Examiner Micke, Kornelia
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

4

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 25 0479

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

27-08-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5328810	A	12-07-1994	NONE

US 2003203320	A1	30-10-2003	AU 2003217896 A1 22-09-2003
			EP 1481283 A1 01-12-2004
			JP 2005519480 T 30-06-2005
			US 2005147901 A1 07-07-2005
